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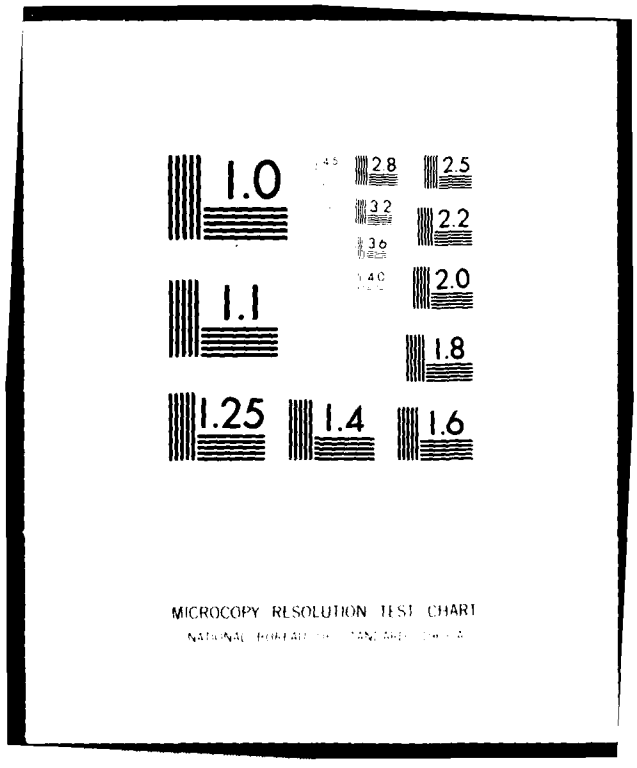
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THE PROBLEM OF OCCLUSAL SURFACE PIT AND FISSURE DENTAL CARIES IN NAVAL RECRUITS

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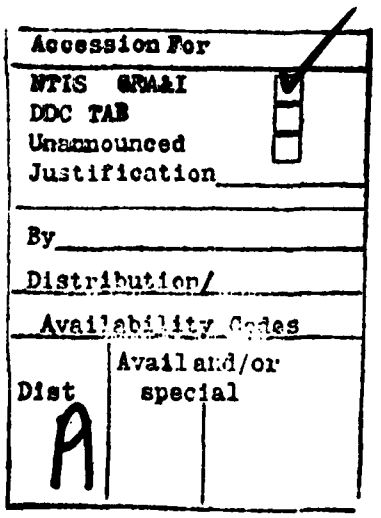

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The prevention of dental caries is a worthy goal, for it would have social and financial values in addition to promoting health and well-being. In the military it has operational significance, too. Prevention of dental caries is especially important in the Navy, since officers and men deploy on ships and may spend as long as ten months at sea before return to home-port. Only about 70 of 455 ships in the U.S. Navy active fleet are staffed with dental officers. Thus, a highly effective preventive dentistry program is a naval service requirement to ensure operational readiness of the crew for extended operations at sea, and to make effective use of limited crew availability during periods of refitting, training and replenishment.

The Navy's preventive dentistry program stresses the physical removal of plaque through educational procedures that will develop proper oral health habits and knowledge. It also provides the topical application of a fluoride solution annually and prior to deployment (1,2). However, the high prevalence of dental caries in naval recruits creates a tremendous burden in the preparation of men as an effective, combat-ready crew. Naval recruits arrive at the Great Lakes Naval Training Center with three times as many unfilled cavities as a comparable age group in the civilian population (3).

The objectives of the epidemiology studies at the Naval Dental Research Institute have been to study the prevalence of dental caries as it relates to treatment needs, and to monitor the incidence of new carious lesions among naval personnel. The purpose has been to be able to identify persons with a high risk for new caries development, so that they may receive the special preventive dentistry treatment necessary to intercept disease, and so enhance personnel performance in the fleet.

To improve the effectiveness of preventive dentistry programs, dental research investigates specific methods which are pertinent to the biology of the dental caries process (2). Streptococcus mutans has been extensively studied with regard to smooth surface dental caries. S. mutans colonizes first on the interproximal and facial smooth surfaces of childrens' teeth (4). A group of randomly selected naval recruits, all having some caries experience, were found to have 71.7% of their proximal smooth surfaces infected with this microorganism (5). These infected sites have been found to harbor 3.6% (6) to 4.5% (5) S. mutans out of the total number of streptococci present. Also, the posterior proximal surfaces are more often infected than anterior surfaces (6). We have found that the overall caries attack rate (CAR) in naval recruits is 2.5%, while their posterior proximal CAR is 4.0% (3). Partial control of these proximal infections can be obtained by operative dentistry and stannous fluoride (SnF_2) topical treatments, augmented by delivering SnF_2 to the proximal surfaces with dental floss (6,7). Thus, preventive dentistry treatment research has been directed towards the high-risk person and high-risk anatomical sites of their teeth.

To date, there has been little attention devoted to occlusal surface pit and fissure dental caries. There is some evidence that tooth morphology is related to susceptibility. The steeper the inner inclined planes of the cusps, the higher the prevalence of dental caries (8,9). The shape of the fissures, as seen in ground cross-sections, may be related to the depth at which dental caries attack begins (10). Teeth

with clinically sound occlusal surfaces have been found in ground sections to reveal dental caries in the fissures (11,12). The first and second molars have been shown to be more susceptible than premolars in adolescents (13-16). These teeth have also been shown most susceptible in caries-free naval recruits who developed their first lesions (17). While sticky glucans are important in the etiology of smooth surface dental caries, occlusal surface pit and fissure caries may be related more to the impaction of food debris and microorganisms into morphological defects (18). The occlusal surfaces in naval recruits have 69.6% of sites positive for S. mutans which comprise 7.8% of the total streptococci (5), but it is not known if they are directly related to the initiation and development of pit and fissure dental caries. Studies of the organisms found within occlusal fissures, to date, have used artificial models (19-22). The peak of caries attack rates have been shown to occur at two to four years after tooth eruption (16), and one could surmise that the caries attack in naval recruits would be on the decline. The purpose of this investigation was to make a determination of the occlusal surface pit and fissure caries attack rates for naval recruits during their first six months of service.

MATERIALS AND METHODS

The subjects were 450 naval recruits selected for training at a technical school at Great Lakes following recruit training. They were examined with mouth mirror and explorer while seated in a dental operating chair. A dental operating light was used for illumination, and compressed air was available for drying the teeth. Bitewing and panoramic radiographs were used as diagnostic adjuncts. The criteria of the World Health Organization (23) were used for the diagnosis of dental caries.* Dental caries experience was scored as decayed (DS), missing (MS) and filled (FS) surfaces (24). Approximately six months after the initial dental examination a second examination was conducted as the subjects completed technical training and were ready for transfer to sea or other duty stations. After the second examination, a record was made of: 1) initially carious surfaces that were filled; 2) teeth extracted because of dental caries; 3) teeth extracted for other reasons (impacted, malposed); 4) untreated surfaces; 5) initially sound surfaces that were subsequently filled; and 6) new carious lesions. Also recorded were those teeth which erupted within the six month interval and the diagnostic reversals which increased the surfaces at risk. Occlusal surfaces which were restored, though sound initially, for access to proximal caries with Class II cavity preparations were excluded from the analysis. With the foregoing adjustments to the number of surfaces at risk the caries attack rate was calculated by the formula:

$$\frac{\text{total caries loss}}{\text{adjusted surfaces at risk}} \times 100$$

This calculation served to express the caries activity per 100 surfaces at risk for individual anatomic sites. On upper molars the distal pits were considered separately from the mesial and central pits because of the usual oblique ridge of enamel between them.

*ICD-DA 521.0

RESULTS

The characteristics of this group of servicemen have been previously reported (3). In general, they present an average of 8.7 DS, 2.4 MS, 11.2 FS, and a DMFS of 21.3. The particular prevalence of dental caries in the occlusal surface pits and fissures is presented in Table 1. Also given in the table are data for third molars which were excluded from the usual DMFS. The highest prevalence of dental caries was found to be in the upper and lower first and second molars. The changes which occurred in the different anatomic sites during the six months are presented in Table 2. The first and second molars were found to have the highest incidence of dental caries. The third molars also presented a high rate of caries incidence, although the number of these teeth present in this population was low. The records of this group of young men disclosed that 2% were free of dental caries and 3% had no remaining sound occlusal surfaces at risk at the first examination. Excluding the third molars, 210 subjects (47%) had no net loss of surfaces at risk. The distribution of net change for all reasons is depicted in Figure 1, which shows that positive caries attack rates were found in about half of the naval recruits. About 30% of the subjects experienced the loss of multiple occlusal surfaces from dental caries.

Although the premolars had both a lower prevalence and incidence of occlusal caries than did the molars, the premolars had many Class II restorations placed which thereby eliminated the pits and fissures. Each tooth type had untreated initial caries and new caries development, but the lower first premolars were the least affected.

DISCUSSION

It is apparent that there are certain men and certain sites on the teeth which are especially caries prone. Caries resistance and susceptibility can be found in the same mouth and even in the same tooth (15). Are the molars more susceptible because they have more cusps, and therefore more fissures, than premolars? Preliminary results from our laboratory suggest that the molars, especially the second molars, of naval recruits are more caries prone because they are more frequently infected with S. mutans (25).

As more is learned of the sites which are caries prone, preventive dentistry treatments should be applied directly to the places where they can have the greatest payoff. Applying fluoride solutions over all surfaces of teeth is certainly of benefit to the treated patient and in large programs is a public health benefit. However, extra attention should be directed to high-risk sites. Application of SnF_2 to proximal sites with dental floss can often reduce the S. mutans infection to zero and it will not return for many months (26). Observations in our laboratory lead us to believe that iodine solutions can reduce the infection in occlusal pits and fissures to zero, but studies have not yet been done to determine how long the effect persists.

In this population of young men, about 70% of the initially carious occlusal pits and fissures were restored. This is a remarkable achievement considering that there is only one day of dental treatment scheduled for

a recruit company, and at times there may be several companies in the clinic at one time. Training schedules are so stringent that there is little time available for recalls to complete the work needed. What of the untreated lesions and the increment of new carious lesions? Since these are not distributed evenly in the population, it would seem that the characteristics of the caries-prone men should be identified and that they should receive extra measures of preventive treatments until they have shown themselves to no longer be at high-risk for dental caries. The extra measures applied should be directed to their posterior proximal surfaces and to the occlusal surfaces of their molar teeth.

While persons could apply personal hygiene measures through use of toothbrushes, toothpicks, dental floss, and fluoride-containing dentifrices to control cariogenic dental plaques on their smooth enamel surfaces, they are vulnerable to attack from microorganisms deep within pits and fissures. A chemical method of treatment for teeth with steep cusps, and minimal or questionable fissure caries, would seem to be a promising dental health measure, but has yet to be investigated for its efficacy. Chemical treatments applied by auxiliary health care personnel would be the most conservative approach and least costly compared to prophylactic odontotomy or preventive resin restorations.

SUMMARY

The prevalence and incidence of occlusal surface pit and fissure dental caries was studied in 450 naval recruits in their first six months of service. The results indicated that about half the men developed new lesions, and 30% were most at-risk. The molars were the most vulnerable. The problem may be amenable to chemical control preventive dentistry measures.

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TABLE 1

THE INITIAL CONDITIONS PRESENT IN OCCLUSAL SURFACE PIT AND FISSURES FOR NAVAL RECRUITS, PER 100 MEN

Occlusal Tooth Area	Total Number Decayed DS	Recurrent Decay* DFS	Missing (Caries Related) MS	Filled FS	Total Caries Experience DMFS	Sound Surfaces at Risk
1-16 Distal	7	0	142 (0)	4	11	48
Mesial, Central	20	0	142 (0)	4	24	35
2-15 Distal	46	3	2 (2)	63	111	88
Mesial, Central	55	3	2 (2)	85	142	58
3-14 Distal	28	4	12 (12)	120	160	40
Mesial, Central	28	3	12 (12)	123	163	37
4-13	15	1	2 (1)	36	52	147
5-12	17	1	19 (1)	25	43	139
21-28	8	0	14 (0)	15	23	164
20-29	19	1	4 (1)	35	55	142
19-30	34	8	22 (21)	114	149	31
18-31	55	6	7 (7)	95	157	43
17-32	17	1	153 (0)	5	22	24

*The number with recurrent decay is also included in the Total Number Decayed.

TABLE 2

OCCLUSAL SURFACE PIT AND FISSURE CHANGES IN THE FIRST SIX MONTHS OF SERVICE FOR 450 NAVAL RECRUITS

Factor	Occlusal Tooth Area* 1-16D	1-16MC	2-15D	2-15MC	3-14D	3-14MC	4-13	5-12	21-28	20-29	19-30	18-31	17-32
Initial caries	31	90	206	246	126	126	67	75	34	87	152	247	77
Filled occlusal	15	28	155	173	99	91	45	52	25	55	89	148	31
Extract for caries	27	27	10	10	11	11	7	5	0	2	15	9	9
Untreated	9	33	72	87	23	29	9	16	5	23	36	86	29
Subsequent filling	20	0	31	24	7	5	0	0	0	0	0	0	0
New caries	16	31	53	49	18	21	19	19	15	25	26	45	24
Initial surfaces at risk	215	158	398	261	179	168	661	627	738	637	139	192	109
Erupted	33	33	1	1	0	0	0	0	0	0	0	0	49
Diagnostic reversal	4	6	22	10	3	7	8	9	9	11	8	9	5
Filled for Class II	0	0	1	0	3	6	62	33	17	38	11	4	0
Extract for reasons other than caries	39	39	0	0	0	0	0	0	0	2	0	0	21
Adjusted surfaces at risk	213	158	420	272	189	169	607	603	730	608	136	197	142
Total caries loss	36	31	84	73	25	26	19	19	15	25	26	45	24
Caries attack rate %	16.9	19.6	20.0	26.8	13.2	15.4	3.1	3.2	2.1	4.1	19.1	22.8	16.9

*D = distal pit, MC = mesial and central pits.

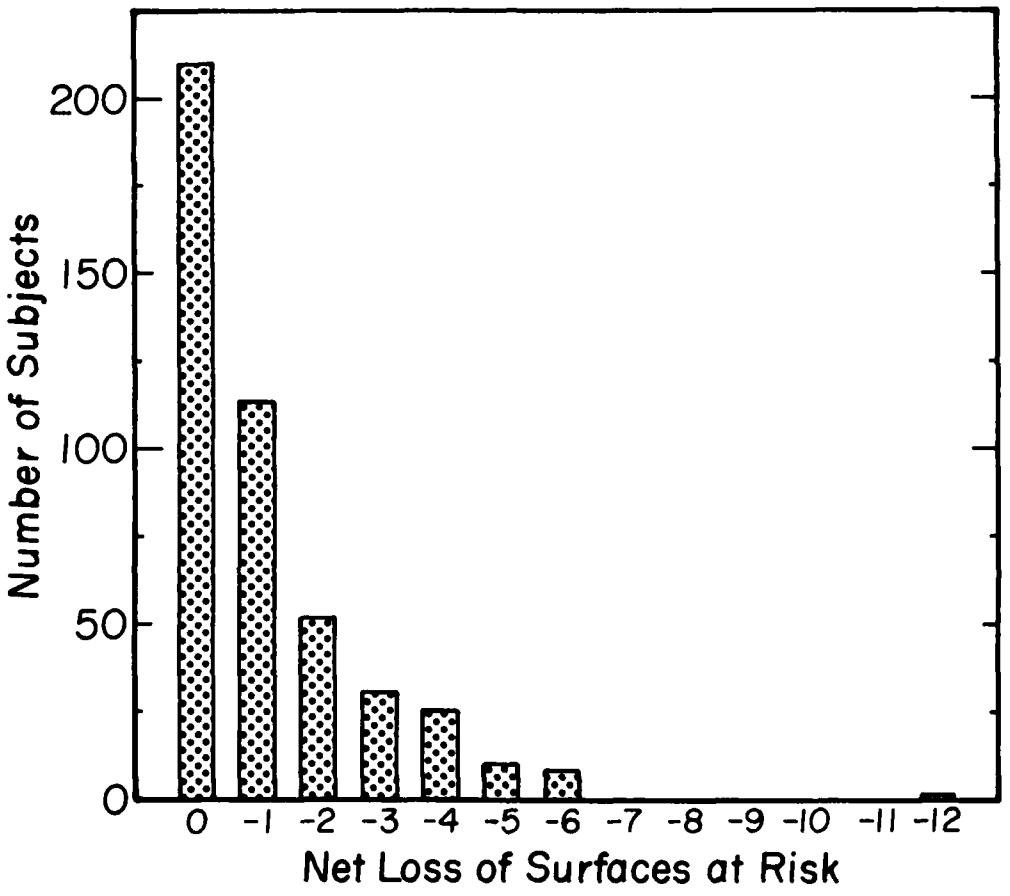

Figure 1. Distribution of the frequency of the net loss of surfaces at risk for all reasons in occlusal surface pit and fissures of naval recruits during their first six months of service. Third molars are excluded. *The 0 column includes diagnostic reversals.

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Dental caries has a high prevalence in naval recruits. This report of their condition presents data on the anatomic sites most caries-prone, the occlusal surface pits and fissures of the molar teeth. Work continues to identify the individuals most caries-prone.

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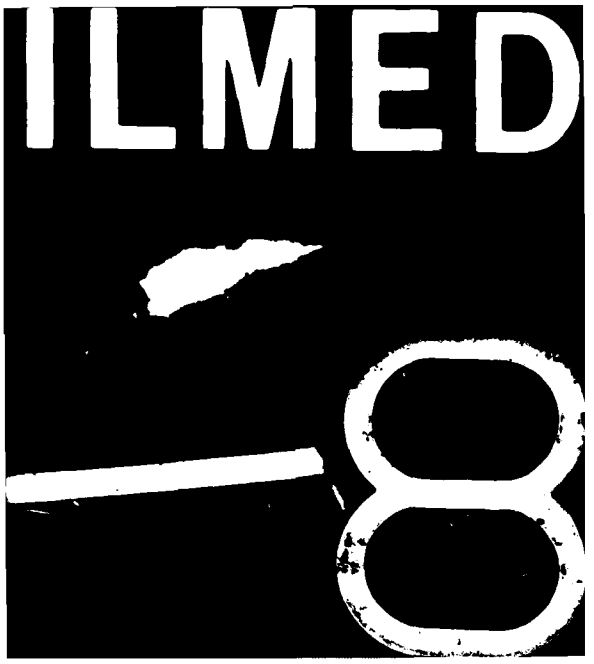
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